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Mill Saw

Field of the Invention

[0001] The invention relates to a mill saw with a saw gate driven via a slider-crank drive, whose parallel saw blades, which cut only in one stroke direction, are provided with a bias, and with a feed conveyor for the stock to be cut, which is driven intermittently during the cutting stroke of the saw gate as a function of the cutting speed by means of at least one motor separated from the slider-crank drive and connected to a controlling system.

Description of the Prior Art

[0002] To ensure, in spite of the sinusoidal speed gradient, regular chip thicknesses over the cutting stroke in case of mill saws with a saw gate driven via a slider-crank drive, the saw blades of which cut in only one stroke direction, the feed conveyor for the stock to be cut must be driven intermittently as a function of the cutting speed. To this end it is common practice to derive the feed drive for the feed conveyor from the slider-crank drive, for instance via a ratchet drive, whereby the feed conveyor for the stock to be cut is connected with the slider-crank drive only during the cutting stroke. As the saw blades are provided with a bias relative to stroke direction, so that the saw blades are disengaged from the stock to be cut

during the return stroke while the feed conveyor is idle, the stock to be cut must first be advanced, via the feed drive, towards the saw blades according to the saw blade disengagement, before any cutting engagement can take place. This requires a lead of the feed drive against the cutting stroke of the saw gate, resulting in a phase displacement between the slider-crank drive and the feed drive derived from the slider-crank drive, so that, as a consequence, the cutting speed reaches its maximum only after the rate of feed. This circumstance entails unregular chips over the cutting stroke and thus unregular stresses of the saw blades with unfavorable consequences for the service life of the saw blades and for the cutting quality, in particular, when parquet lamellas shall be cut of commercially available stock lumber.

[0003] Problems are similar when the feed conveyor for the stock to be cut is equipped with a motor separated from the slider-crank drive of the saw gate that is driven intermittently as a function of the slider-crank drive, for instance by joining up the hydraulic motor of the feed drive intermittently into the pump circuit via a reversing valve (DE 34 06 455 A). Here the reversing valve is controlled via a reversing shaft that is in a driving connection with the slider-crank drive. By intermittently reversing the control valve via the reversing shaft, however, irregular saw blade stress cannot be avoided.

Summary of the Invention

[0004] The invention has therefore the objective to design a mill saw of the above mentioned kind in such a way that favorable cutting features are ensured to guarantee a long service life of the saw blades at comparatively high cutting rates.

[0005] The objective of the invention is achieved in that the controlling system connected to a signal transmitter for a preset position of rotation of the slider-crank drive controls the motor in dependence on the response of the signal transmitter according to a stored control program for a conveying step adaptable to the respective stroke frequency of the slider-crank drive.

[0006] To achieve, for example, a regular thickness of the saw chips over the cutting stroke that is favorable in terms of saw blade stress, the speed gradient of the feed conveyor must be exactly matched with the gradient of the cutting speed of the saw gate during the cutting stroke after overcoming the saw blade disengagement, which requires a sufficiently accurate motor control, if the feed drive is independent of the slider-crank drive. According to the invention, this accurate motor control is simply achieved in that, contrary to the conventional mechanical drive connection between the slider-crank drive and the feed conveyor, where each angle of rotation of the slider-crank drive is assigned with an angle of rotation for the motor of the feed drive, the motor is controlled via a controlling system according to a stored control program for a conveying step, so that, for executing such a conveying step of the feed conveyor, it is only required to cycle the controlling system via the slider-crank drive. To this end a signal transmitter for a preset position of rotation of the slider-crank drive is to be provided. Due to the inertia of the moving masses the prerequisite for such a control of the driving motor cycled by the slider-crank drive, that there be only a trifling change of the rotating speed during the cutting stroke of the saw gate, is fulfilled in case of mill saws. It only needs to be provided for that the chronological sequence of the stored control program is adapted to the respective stroke frequency of the slider-crank drive, which is not difficult at all, as the controlling system is admitted with the respective stroke frequency for a given position of rotation of the slider-crank drive via the signal transmitter.

[0007] Although basically each position of rotation of the slider-crank drive is suitable for cycling the controlling system, particularly favorable constructional features are achieved, if the signal transmitter consists of a sensor for the dead center of the slider-crank drive at the end of the cutting stroke, as in this case the signal transmitter can be easily assigned with the saw gate guide, without having to provide complex adjustment facilities. The dead center at the end of a cutting stroke makes it possible for the feed drive to set in already with the next cutting stroke in spite of the lead necessary for overcoming the saw blade disengagement.

[0008] The conveying distance of the stock to be cut for overcoming the saw blade disengagement depends only on the chosen bias of the saw blades, and is independent of

the stroke frequency of the saw gate. Therefore, the controlling system may be provided with memories for a control program dependent on the speed of the slider-crank drive and one independent thereof, which latter provides for feeding the stock to be cut according to the saw blade disengagement determined by the bias of the saw blades. This subdivision of the control program into one part dependent on the stroke frequency of the saw gate and one independent thereof is particularly recommended, if the controlling system is connected to an input unit for different control parameters, via which, for instance, the feed shall be varied to adapt to various chip thicknesses.

[0009] If the feed drive is provided with two motors separately controllable via the controlling system and assigned with the feed conveyor in feed direction upstream and downstream of the saw gate, the feed conveyors upstream and downstream of the saw gate may be driven at different speeds, whereby the application of tensile forces and/or forces of pressure to the stock to be cut in the cutting area becomes possible.

Brief Description of the Drawing

[0010] The drawing depicts an example of the subject matter of the invention.

Fig. 1 represents a schematic side view of the mill saw according to the invention.

Fig. 2 is a schematic block diagram of the slider-crank drive for the saw gate and the feed drive for the stock to be cut.

Fig. 3 depicts the stroke gradient related to time of the saw gate driven via the slider-crank drive and

Fig. 4 shows the speed gradient related to time of the saw gate on the one hand, and the speed gradient related to time of the feed drive on the other hand.

Description of the Preferred Embodiment

[0011] In the example of embodiment according to Fig. 1 the stand 1 of a mill saw is provided with a stroke guide 2 for a saw gate 3 that can be driven to and fro by means of a slider-crank drive 4. The parallel saw blades 5 of the saw gate 3 are gripped conventionally

into a gate frame, which is borne in the saw gate 3 with an adjustable bias. For guiding the stock to be cut a feed conveyor 6 is provided, which consists of driven conveyor rolls 7 arranged upstream and downstream of the saw gate 3, to which rolls 7 the stock to be cut is pressed via snubber rolls 8, which can be set via adjustment cylinders 9. Contrary to conventional feed conveyors 6 the conveyor rolls 7 are not driven via the slider-crank drive 4, but via separate motors 10 with a driving connection via chain drives 11 according to Fig. 2. For controlling these motors 10, designed as gear motors, there is a controlling system 12 comprising a computer unit 13 according to Fig. 2, via which the setpoints are preset to the position controllers 14 for the motors 10. On the basis of these setpoints the motors 10 are controlled according to the requirements of feed via a setpoint/actual-value adjustment. The selection of setpoints if effected via control programs stored in the program memories 15 and 16. In this connection the arrangement has been chosen such that the feed conveyor 6 performs one conveying step each via the mtoros 10, as soon as the controlling system 12 is triggered via a signal transmitter 17 for the dead center of the slider-crank drive 4 at the end of a cutting stroke.

[0012] By the example of Fig. 3 and Fig. 4 the control sequence for the motors 10 can be explained in detail. Fig. 3 shows the gradient 18 of the stroke h of the saw gate 3 over the time t around a mean stroke position h_m between an upper dead center h_o and a lower dead center h_u, with the cutting stroke in cutting direction of the saw blades ensuing from the downward movement of the saw gate 3 from the upper dead center h_o to the lower dead center h_u. Due to the sinusoidal stroke gradient 18 related to time of the saw gate 3 the speed gradient related to time for the saw gate 3 corresponds with the characteristic 19 of Fig. 4. The speed v above the time base t is equivalent to the cutting speed of the saw blades 5 during the cutting stroke.

[0013] To be able to ensure a regular chip thickness over the cutting stroke, the feed conveyor 6 must be driven in phase with the saw gate 3. An appropriate rate of feed v_s for the feed conveyor 6 is depicted in Fig. 4, from which it can also be inferred that, according to the speed gradient 19 below the time base t, there must not be any feed of the stock to be cut during the return stroke of the saw gate 3.

[0014] The bias of the saw blades 5 necessary for the disengagement of the saw blades 5 during the return stroke requires that the disengagement of the saw blades 5 against the bottom of the cutting grooves must be overcome first, before the saw blades 5 are able to engage into the stock to be cut. This means that the feed conveyor 6 must be driven to lead in such a way that the stock to be cut is set to cutting position to the saw blades 5 at the beginning of a cutting stroke. To this end the stock to be cut must be conveyed, prior to the cutting stroke, by a distance equivalent to the disengagement of the saw blades 5, which distance is determined by the adjusted bias, so that the necessary setting of the stock to be cut can be ensured at an appropriate speed gradient v_a via the feed drive.

[0015] As the time period required for the advanced setting of the stock to be cut is determined at a speed gradient v_a selected by the program, only a lead time t_v needs to be allowed for to control, after response of the signal transmitter 17 at the time t_{s1} in the lower dead center h_u of the saw gate 3, the motors 10 according to the speed gradients v_a and v_s, which are ensured by the control programs in the memories 15 and 16. Each time the controlling system 12 is triggered via the signal transmitter 17 at the time t_s, the feed drive is actuated according to the speed gradients v_a and v_s after a lead time t_v, whereby the desired intermittent feed drive is ensured. As can be inferred from Fig. 3 and Fig. 4, the time control of the motors 10 depends on the stroke frequency of the slider-crank drive. Therefore the speed gradient v_s must be adapted to the respective stroke frequency, just as it is also necessary to adapt the lead time t_v to the stroke frequency. For this purpose the control program stored in the memory 16 that depends on the stroke frequency of the saw gate 3 is computed with the respective stroke frequency in the computer unit 13 in such a way that the respective setpoints can be preset to the position controllers 14 as a function of the respective stroke frequencies. The stroke frequency proper is input to the computer unit 13 via an averaging unit 20, so that possible variations can be compensated.

[0016] To be able to adapt the rates of feed to the various requirements, the parameters to be preset for this purpose can be entered to the controlling system 12 via an input unit 21. Via these parameters, for instance, the amplitudes of the speed gradients v_s may be varied,

as this is outlined in dashes in Fig. 4. Via appropriate parameters, however, it is also possible to allow for variations in the area of the bias of the saw blades 5 to adapt the speed gradient v_a accordingly.